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AMENDED CLAIMS

[received by the International Bureau on 1 December 2004 (01.12.04),
original claims 1 to 30 replaced by new claims 1 to 65 (10 pages)]

1. A nozzle arrangement adapted to be fitted to an outlet of a fluid supply and to generate a spray of fluid dispensed from said fluid supply during use, said nozzle arrangement having a body which comprises:

5 (1) actuator means which is adapted, upon operation, to cause fluid to flow from said fluid supply and through said nozzle arrangement;

(2) an inlet through which fluid from said fluid supply accesses the nozzle arrangement during use;

10 (3) one or more outlet orifices through which fluid is ejected from the nozzle arrangement during use; and

(4) an internal fluid flow passageway which connects said inlet to said one or more outlet orifices;

15 said fluid flow passageway further comprising an internal chamber, said chamber having two or more inlet orifices, and at least one outlet orifice through which fluid may exit the chamber; characterised in that:

20 said chamber has a first plurality of inlet orifices in any one wall thereof, said first plurality of inlet orifices being configured to direct fluid into said internal chamber non-tangentially to said any one wall so that the fluid entering through said first plurality of inlet orifices crosses at least part of the chamber before contacting a wall of the chamber and, where all the inlet orifices enter the chamber from an upstream end, some or all of the inlet orifices direct the fluid accessing the chamber along mutually divergent or mutually convergent paths.

2. A nozzle arrangement according to claim 1, wherein at least two of said first plurality of inlet orifices are located in different planes perpendicular to the longitudinal axis of the chamber.
3. A nozzle arrangement according to claim 2, wherein said first plurality of inlet orifices enter the chamber through a side thereof.
4. A nozzle arrangement according to claim 3, wherein said first plurality of inlet orifices are configured so as to direct fluid into the chamber along paths that are substantially parallel to one another.
5. A nozzle arrangement according to claim 3, wherein at least some of said first plurality of inlet orifices are configured to direct fluid into the internal chamber along paths that are mutually convergent or mutually divergent.
6. A nozzle arrangement according to any one of claims 1 to 5, wherein said first plurality of inlet orifices enter the chamber from any one side therefore, said nozzle arrangement further comprising one or more additional inlet orifice that enters the chamber from the upstream end or from any side thereof.
7. A nozzle arrangement according to claim 6, wherein there is more than one additional inlet orifice.
8. A nozzle arrangement according to claim 7, wherein said more than one additional inlet orifices are arranged to direct fluid streams into the chamber along substantially parallel paths.
9. A nozzle arrangement according to claim 7, wherein at least some of said more than one additional inlet orifices are arranged to direct fluid into the chamber along mutually divergent or mutually convergent paths.

10. A nozzle arrangement according to any preceding claim, wherein the fluid accessing the chamber through at least one of said orifices is directed towards an internal wall of the chamber.
11. A nozzle arrangement according any preceding claim, wherein at least 5 some of the inlet orifices into said chamber are outlets from ducts or passages.
12. A nozzle arrangement according to claim 11, wherein said ducts or passages lead from a space or chamber downstream of said chamber to the orifices in said chamber.
13. A nozzle arrangement according to any preceding claim, wherein said 10 chamber has outlet means comprising a plurality of ducts or passages leading to a plurality of outlet orifices.
14. A nozzle arrangement according to claim 13, wherein the outlet orifices are outlet orifices of the nozzle arrangement.
15. A nozzle arrangement according to claim 13 or claim 14, wherein said 15 plurality of ducts or passages are mutually divergent.
16. A nozzle arrangement according to any preceding claim, wherein said chamber has outlet means comprising an outlet orifice of the nozzle.
17. A nozzle arrangement according to claim 16, wherein a swirl chamber is connected between said chamber and said outlet orifice.
- 20 18. A nozzle arrangement according to any previous claim, wherein said first plurality of inlet orifices enter the chamber through one side thereof, said first plurality of inlet orifices being fed from a by-pass passage that leads from said downstream space or chamber to said internal chamber.

19. A nozzle arrangement according to any one of claims 6 to 9, wherein said one or more additional inlet orifices direct fluid to intersect the flow paths from said first plurality of inlet orifices.
20. A nozzle arrangement according to any one of claims 6 to 9, wherein, in
5 use, said first plurality of inlet orifices are fed with a first fluid and said one or more additional inlet orifices are fed with a second, different fluid.
21. A nozzle arrangement according to claim 20, wherein the different fluids are both liquors.
22. A nozzle arrangement according to claims 20, wherein one fluid is liquor
10 and the other a gas.
23. A nozzle arrangement according to claim 22, wherein the gaseous medium is introduced into said internal chamber via said one or more additional inlet orifices as a tangential or a perpendicular stream.
24. A nozzle arrangement according to claim 22, wherein the streams of
15 gaseous medium entering the internal chamber through said one or more additional inlet orifice is directed to intersect the paths of fluid entering the internal chamber through said first plurality of inlet orifices.
25. A nozzle arrangement according to claim 12, wherein liquor is fed tangentially to the downstream space, and gaseous medium is fed direct to the
20 downstream space where they are mixed.
26. A nozzle arrangement according to claim 1, wherein the internal chamber comprises an expansion chamber and has two or more inlet orifices and one or more outlet orifice, said inlet orifices being arranged in a divergent relationship to one another so that the fluid passing through the internal
25 passageway accesses the chamber through said inlet orifice or orifices along independent and divergent paths.

27. A nozzle arrangement according to claim 26, wherein said divergent inlet orifices direct fluid towards opposing internal walls and/or corners of the chamber.

28. A nozzle arrangement according to claim 26, wherein the fluid entering
5 the chamber is directed towards an opposing wall of the expansion chamber, or
a corner between an opposing wall and an adjacent wall of the expansion
chamber.

29. A nozzle arrangement according to claim 26, wherein one or more posts
or protrusions are positioned within the chamber to provide internal wall
10 surfaces towards which the fluid may be directed.

30. A nozzle arrangement according to any one of claims 26 to 29, wherein
the fluid is directed towards one or more nodules formed on the internal walls
and/or corners of the chamber, said nodules being configured to cause further
agitation or disturbance to the fluid stream within the chamber.

15 31. A nozzle arrangement according to any preceding claim, wherein the, or
each, outlet orifice directs fluid exiting the chamber into a continuation of the
passageway.

32. A nozzle arrangement according to any one of claims 26 to 31, wherein
the chamber is disposed next to the outlet and the, or each, outlet orifice of the
20 expansion chamber also constitutes an outlet orifice of the nozzle arrangement.

33. A nozzle arrangement according to claim 1, wherein the internal
chamber has two or more inlet orifices disposed in a convergent relationship to
one another so that the fluid streams flowing through the inlet orifices into the
chamber are directed toward one another and mix within the chamber.

25 34. A nozzle arrangement according to any preceding claim, said internal
chamber is configured to have a width extending transversely of the flow.

passage and a depth perpendicular to said width which is greater than said width.

35. A nozzle arrangement according to claim 34, wherein said internal chamber has curved interior surfaces defining an elliptical cross-section to said chamber the major axis of which constitutes the depth.

36. A nozzle arrangement according to claim 34, wherein said internal chamber has plane interior surfaces defining a rectangular or other polygonal cross-section to said chamber.

37. A nozzle arrangement according to claim 34, wherein two or more of 10 said chambers extend in parallel and are provided in independent multiple flow paths of said flow passage.

38. A nozzle arrangement according to any previous claim, wherein, the passageway comprises two or more of said internal chambers.

39. A nozzle arrangement according to claim 38, wherein, said internal 15 chambers are arranged in series or in parallel.

40. A nozzle arrangement adapted to be fitted to an outlet of a fluid supply and to generate a spray of fluid dispensed from said fluid supply during use, said nozzle arrangement having a body which comprises:

- (1) actuator means which is adapted, upon operation, to cause fluid to flow from said fluid supply and through said nozzle arrangement;
- (2) an inlet through which fluid from said fluid supply accesses the nozzle arrangement during use;
- (3) one or more outlet orifices through which fluid is ejected from the nozzle arrangement during use; and

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(4) an internal fluid flow passageway which connects said inlet to said one or more outlet orifices;

said fluid flow passageway further comprising an internal chamber, said chamber having two or more inlet orifices, and at least one outlet orifice
5 through which fluid may exit the chamber; characterised in that:

said internal chamber has a plurality of inlet orifices that enter laterally from the side of the chamber, the arrangement being such that where each said lateral inlet orifice is arranged to direct fluid into the chamber tangentially on to the wall of the chamber adjacent the respective inlet orifice, two or more of said
10 lateral inlet orifices are arranged to direct streams of fluid into the chamber in generally opposing circumferential directions.

41. A nozzle arrangement according to claim 40, wherein each of said lateral inlet orifices is arranged to direct fluid into the chamber tangentially on to the wall of the chamber adjacent the respective inlet orifice and two or more of said
15 lateral inlet orifices are arranged to direct fluid into the chamber in generally opposing circumferential directions.

42. A nozzle arrangement as claimed in claim 41, wherein said two or more lateral inlet orifices are provided on a common plane perpendicular to the longitudinal axis of the chamber.

20 43. A nozzle arrangement as claimed in claim 41 or claim 42, wherein at least one of said two or more lateral inlet orifices has a larger cross-sectional area than at least one other of said two or more lateral inlet orifices.

44. A nozzle arrangement as claimed in any one of claims 41 to 43, wherein there are more than two lateral inlet orifices, at least two of said lateral inlet
25 orifices are arranged to direct streams of fluid in generally opposing circumferential directions.

45. A nozzle arrangement as claimed in any one of claims 41 to 43, wherein all the lateral inlet orifices are located on a common plane perpendicular to the longitudinal axis of the chamber.
46. A nozzle arrangement as claimed in any one of claims 41 to 43, wherein some of the lateral inlet orifices are arranged on different planes perpendicular to the longitudinal axis of the chamber so as to be spaced along the chamber.
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47. A nozzle arrangement as claimed in claim 46, wherein there are more than two lateral inlet orifices in each said plane, at least two of said lateral inlet orifices in each said plane being arranged to direct streams of fluid into the chamber in generally opposing circumferential directions.
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48. A nozzle arrangement according to claim 40, wherein two or more of said lateral inlet orifices are configured to direct fluid in to the chamber non-tangentially, such that the fluid is directed by said at two or more lateral inlet orifices across at least part of the chamber along paths that do not cross each other before they intersect a curved wall portion of the chamber opposite the respective inlet orifices.
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49. A nozzle arrangement as claimed in claim 48, wherein at least one of said two or more lateral inlet orifices has a larger cross-sectional area than at least one other of said two or more lateral inlet orifices.
- 20 50. A nozzle arrangement as claimed in claim 48 or claim 49, wherein at least two of said two or more lateral inlet orifices are arranged in a common plane perpendicular to the longitudinal axis of the chamber.
51. A nozzle arrangement as claimed in any one of claims 48 to 50, wherein the two or more lateral inlet orifices are configured to direct fluid into the chamber along substantially parallel paths.
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52. A nozzle arrangement as claimed in any one of claims 48 to 51, wherein at least two of said two or more lateral inlet orifices enter from opposite sides of the chamber so as to direct fluid streams across the chamber in generally opposing lateral directions.

5 53. A nozzle arrangement as claimed in any one of claims 48 to 51, wherein at least two of said two or more lateral inlet orifices enter from the same side of the chamber so as to direct fluid streams across the chamber in the same general lateral direction.

10 54. A nozzle arrangement as claimed in any one of claims 40 to 53, wherein the chamber has a single outlet orifice.

55. A nozzle arrangement as claimed in claim 54, wherein the outlet orifice is located centrally in a downstream end of the chamber.

56. A nozzle arrangement as claimed in any one of claims 40 to 53, wherein the chamber has more than one outlet orifice.

15 57. A nozzle arrangement as claimed in any one of claims 40 to 56, wherein the, or each, outlet orifice from the chamber comprises an outlet or final spray orifice of the nozzle arrangement.

20 58. A nozzle arrangement as claimed in any one of claims 40 to 56, wherein the, or each, outlet orifice from the chamber directs fluid exiting the chamber into a continuation of the nozzle arrangement upstream from the final outlet orifice or orifices of the nozzle arrangement.

59. A nozzle arrangement as claimed in claim 58, wherein a swirl chamber is provided in the continuation of the nozzle arrangement prior to the final outlet orifice or orifices of the nozzle arrangement.

60. A nozzle arrangement as claimed in any one of claims 40 to 59, in which the chamber has a circular cross-section.

61. A nozzle arrangement as claimed in any one of claims 40 to 59, wherein the chamber has a non-circular cross section.

5 62. A nozzle arrangement as claimed in any one of claims 40 to 61, wherein one or more additional fluid inlet orifices enter the chamber from an upstream end thereof.

63. A nozzle arrangement as claimed in claim 62, wherein said one or more additional inlet orifices are configured to direct fluid longitudinally into the
10 chamber.

64. A nozzle arrangement as claimed in any one of claims 40 to 63, wherein all the inlet orifices are arranged to feed a single liquor into the chamber from the fluid source.

65. A nozzle arrangement as claimed in claim 63, wherein the
15 additional inlet orifices are arranged to feed a gas, such as air, into the chamber whilst the lateral inlet orifices are adapted to feed a liquor into the chamber.